

Solar Two: Clean Power On Demand

Since beginning its start-up phase in 1997, the 10-MW Solar Two pilot plant has been performing near its design levels, demonstrating the potential of molten-salt solar power tower technology to deliver large quantities of electric power to the grid reliably, efficiently, and on demand.

Solar Two has operated successfully over the past year. In fact, as the plant operators gain familiarity with the systems, daily operation has become routine, and performance records of all types have been broken on a regular basis. With its planned test and evaluation program nearly complete, Solar Two is demonstrating key attributes of solar power tower plants: efficient collection and storage of the sun's energy, and dispatch of electricity as needed by the utility grid. Some key accomplishments by Solar Two in 1998 include the following:



Close-up of Solar Two showing heliostat field and tower.

- **Dispatchability:** Using its unique and extremely efficient thermal storage system, Solar Two delivered electricity to the grid around-the-clock for 153 straight hours (nearly a full week), *all from clean, renewable solar energy.*
 - **Efficiency:** The receiver efficiency in low-wind conditions was measured at 88%, matching design specifications. Efficiency of the storage system has been measured at 97%, also meeting design goals.
 - **Power Output:** Solar Two produced 1633 MWh over a 30-day period, exceeding its one-month performance measure of 1500 MWh of power production; the plant also produced a record turbine power output of 11.6 megawatts.
 - **Reliability:** During one stretch in the summer of 1998, the plant operated for 32 of 39 days (four days down because of weather, one day because of loss of offsite power, and only two days for maintenance), representing a 94% run-day availability.
 - **Parasitic Power Use:** The electrical parasitic energy load—electricity required to run the plant—was reduced significantly and now meets the design goal regularly.
- These accomplishments illustrate the potential that molten-salt power tower plants have to provide clean, dispatchable solar power to the grid. At Solar Two, because of storage, electric energy can be dispatched after dark and during periods of cloudy weather. The use of molten salt storage has another important benefit in that it provides for simplified system operation, because the collection of solar energy is isolated from electric energy production.
- Solar Two's major objectives are to demonstrate that the technology will work as predicted and to resolve problems that might affect future commercial plants. The plant is serving that purpose well—identifying the issues and solutions that will be needed to build the next plant successfully. As

continued on back page



anticipated in a pilot plant, problems associated with specifics of design, construction, and operation have been encountered, including several component failures that resulted in temporary plant outages. None, however, have been showstoppers or pose any threat to the technology. Solutions have already been found to most issues, either through design improvements, better quality control during construction, or modifications to operating and maintenance procedures. Most solutions were implemented at Solar Two, but a few are significant enough in scope that they can only be implemented in the next plant. In those cases, workarounds were identified to allow continued successful operation and testing at Solar Two.

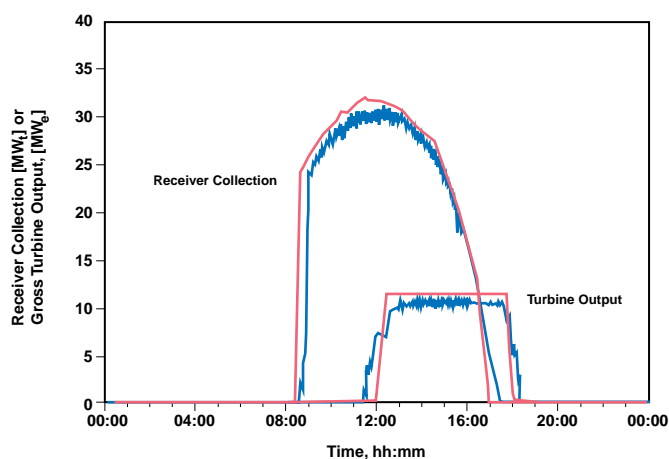
Long-term reliability, an important issue with potential investors in commercial plants, remains as one issue not totally demonstrated by Solar Two. Routine operations of the plant indicate that the technology should be able to achieve high reliability over extended periods, although the pilot plant nature of Solar Two will not provide long-term data to prove this definitively. Results to date suggest that demonstrating required reliability would be achievable, were funds available for extended operation.

Identifying these key issues and their resolution has, in itself, been an important accomplishment of Solar Two. The resulting data allow performance models to be refined and the performance of future commercial plants predicted with enough confidence to attract investors in the technology.

In summary, Solar Two has successfully demonstrated that molten-salt solar power tower plants can provide large-scale electric power whenever the customer demands it. Operation to demonstrate long-term reliability is progressing, as is work to optimize plant performance and to maximize the efficiency of converting solar energy to electric energy. Detailed tests are also being conducted to characterize the behavior and performance of all the major equipment in the plant. These efforts will be critical to future investors in large solar power plants—plants that will be needed to meet the world's future demand for clean, renewable electricity. Being the first molten-salt power tower, Solar Two is similar to the first trough power plant, SEGS I. Solar Two is successfully establishing the groundwork that will allow the next 30-MW or larger power tower to be built with confidence, just as SEGS I gave investors confidence to proceed with SEGS II, and then the additional successful trough plants that followed.



Solar Two delivers power to the grid on demand, even hours after sunset, using its highly efficient thermal storage system.



The actual receiver collection and turbine output on a recent September day (blue) approaches the modeled performance (pink) as predicted by the SOLERGY computer code.

For on-line information about the U.S. Department of Energy's Concentrating Solar Power Program, please visit its web site at: <http://www.eren.doe.gov/sunlab>

For more information on renewable energy or for additional copies of this brochure, contact the Energy Efficiency and Renewable Energy Clearinghouse (EREC): 1-800-DOE-EREC (363-3732)



Produced for the
U.S. Department of Energy (DOE)
1000 Independence Avenue, S.W.
Washington, DC 20585-0121



Produced by **Sun•Lab:**
Bringing together solar energy expertise from
Sandia National Laboratories and the National
Renewable Energy Laboratory, DOE national
laboratories.

SAND99-0663
November 1998